

(12) **UK Patent Application** (19) **GB** (11) **2 234 970** (13) **A**
(43) Date of A publication 20.02.1991

(21) Application No 9014637.4

(22) Date of filing 02.07.1990

(30) Priority data

(31) 8915645

(32) 07.07.1989

(33) GB

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(51) INT CL⁵

C03B 11/10

(52) UK CL (Edition K)

C1M MKE M422

U1S S1808

(56) Documents cited

None

(58) Field of search

UK CL (Edition K) C1M MEG MFC MFF MKE MKN

INT CL⁵ C03B

Online search using dialog: WPI

(54) **Spike detection during the manufacture of hollow glass articles**

(57) Method comprises emitting a signal between the mould and the plunger/mechanism of the article forming means, receiving the emitted signal, and detecting any deviation in the received signal due to the presence of a spike(s), from a norm that is expected when no spike(s) exists.

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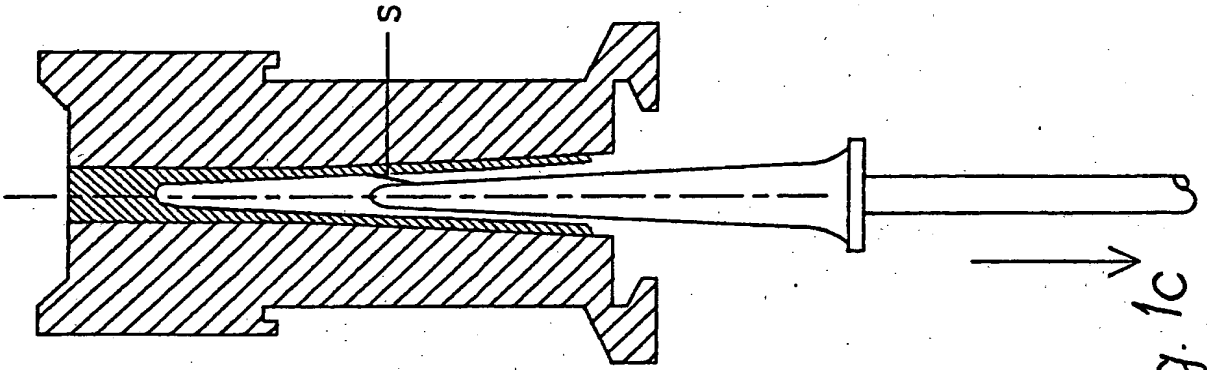


Fig. 1c

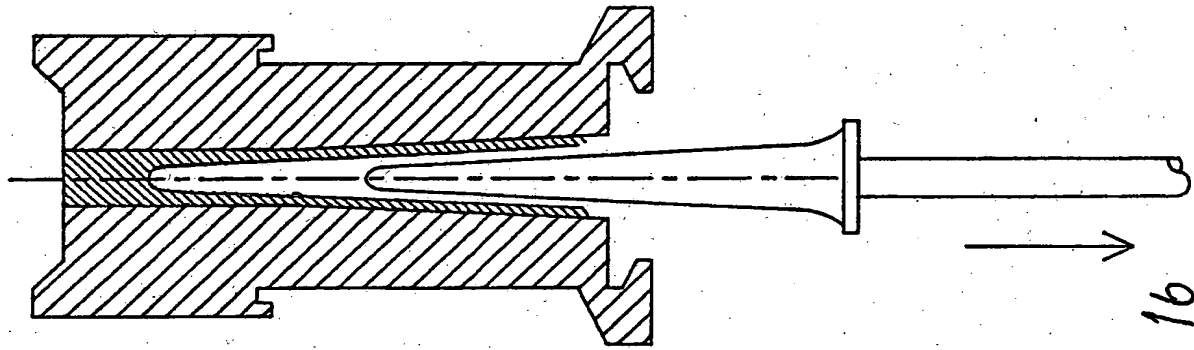


Fig. 1b

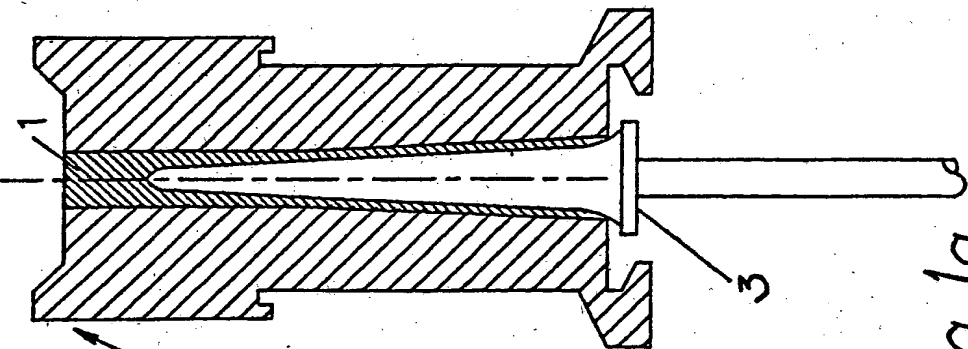
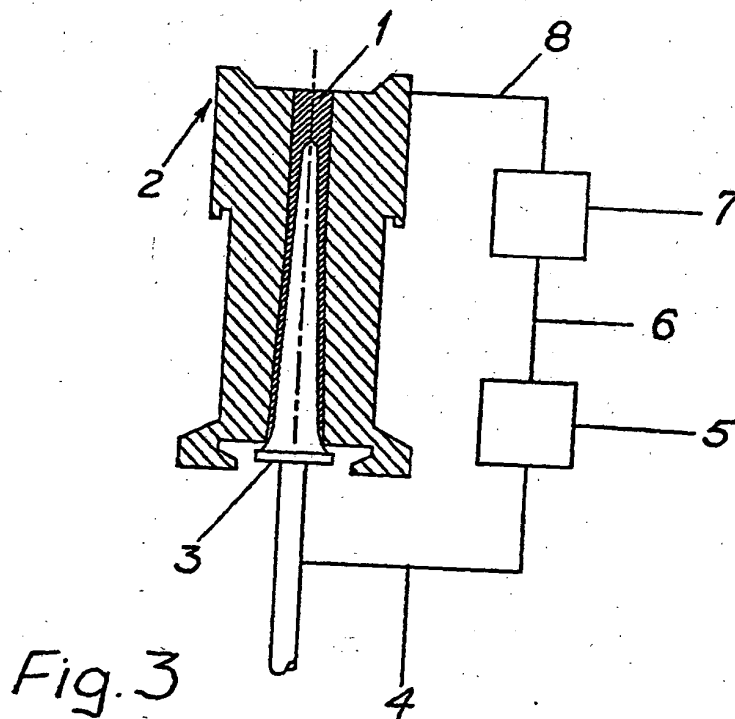
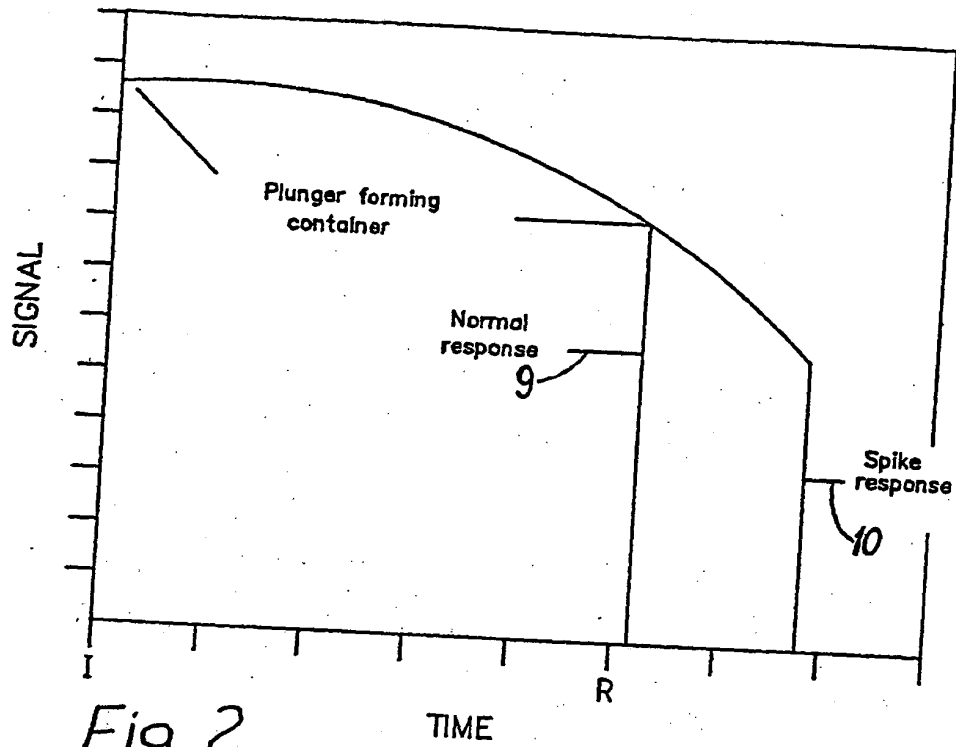


Fig. 1a



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SPIKE DETECTION DURING THE MANUFACTURE OF HOLLOW GLASS ARTICLES

This invention relates to the manufacture of hollow glass articles or containers such as bottles, jars etc., and in particular to the detection of so-called spikes (as hereinafter defined), as part of production monitoring.

Basically, in the manufacture of hollow glass articles, a gob of glass, heated to a suitable workable temperature, is located in forming means comprising a mould and a co-operating plunger (as hereinafter defined), the latter being forced into the gob to produce an initial shaping of the required article. However, if the control of the temperatures in certain components of the article forming machine wander beyond prescribed parameters, spikes are formed between the plunger and the inside of the semi-formed glass article as the plunger is withdrawn.

By "plunger" is meant any plunger, plug or other mechanical device which contacts the glass surface, and/or its associated support and/or displacement mechanism.

By "spikes" are meant threads of glass which are randomly pulled from the inside of the semi-formed article, usually in base and neck areas, due to adhesion of the glass to the plunger. Such spikes are very difficult to detect, are very fine and sharp, and frequently, upon cooling, break off and become lodged within the finished-formed container, and consequently and most disadvantageously become mixed with the eventual contents of the container. Moreover, large

numbers of imperfect articles can be manufactured before it is realised that conditions under which spikes are formed are pertaining.

According to a first aspect of the present invention, there is provided a method of detecting the formation of spikes during the manufacture of hollow glass articles comprising emitting a signal between the mould and the plunger/mechanism of the article forming means, receiving the emitted signal, and detecting any deviation in the received signal due to the presence of a spike(s), from a norm that is expected when no spike(s) exists.

According to a second aspect of the present invention, there is provided apparatus for carrying out the above defined method, comprising;

(i) signal emitter means attachable to the plunger/mechanism or to the mould of forming means of a hollow glass article forming machine;

(ii) signal receiver means attachable to the mould or to the plunger/mechanism, respectively, to receive the emitted signal; and

(iii) detection means capable of determining whether the received signal has deviated, due to the presence of a spike(s), from a norm that is expected when no spike(s) exists.

The invention thus provides a method and apparatus in which a spike can be detected during its formation, by monitoring any deviation, distortion, interference tc., of the signal received by the receiver means, and upon such

deviation being detected suitable adjustments to the forming machine can be made to avoid spike formation. This contrasts with prior art techniques which have relied upon the ability to detect a spike, usually by visual inspection, in a finished article.

[REDACTED] across the forming means can be [REDACTED] ultrasonic, R.F. microwave, light or vibration.

For instance, with an electrical signal from the plunger to the mould, the plunger is electrically insulated and a current is applied to the plunger whilst it is forced by its support and/or displacement mechanism into the gob, the current flowing through the glass and into the mould, with the circuit completed via the mould. If no spikes are present, the circuit is broken instantaneously upon "clean" retraction of the plunger from the interior of the semi-finished article, and such circuit breaking is readily detectable and recognisable as a norm. On the other hand, if one or more spikes are present, the circuit is not instantaneously broken upon retraction of the plunger but is maintained to some extent via the spike(s) and consequently detectable current for example continues to flow, thereby deviating from the norm, to provide an alarm signal, e.g. to control equipment, to enable an article(s) in which a spike is detected to be rejected before entering the Lehr, and to set in motion adjustments to the forming machine, notably to its cooling system to preclude spike formation. With the emission of electrical signals as exemplified above, the invention uses the electrical conductive properties of glass, and in

particular a spike, in the course of its formation, as a means of monitoring conditions between the semi-finished glass article and the plunger in particular during the retraction of a plunger from a mould of a forming means. In detail, one embodiment of the apparatus could be provided with resistance and/or current and/or voltage sensing units, together with timing circuits, the sensing or measurement of a voltage etc. in a time slot exceeding the norm that is required to operate the machine satisfactorily, indicating that a spike is being formed. In an alternative embodiment, suitable circuitry is provided to enable analysis to be made of the electrical waveform produced during plunger retraction, with variation of the waveform from the expected norm indicating spike formation.

The invention will now be described in greater detail, by way of example, with reference to the accompanying drawings, in which:-

Figures 1A, 1B and 1C show diagrammatically three aspects of the pre-forming of a gob of glass;

Figure 2 is a graph of the monitored signal; and

Figure 3 is a suitable circuit diagram.

In Figure 1A, a gob 1 of glass at workable temperature is contained within a pre-forming housing 2 and a reciprocable plunger 3 has been pressed into the gob 1 to effect preforming. The housing 2 is metallic, as is the plunger 3, and hence both components are electrically conductive. Hence as in Figure 3, an electrical signal is supplied to the plunger 3 via lead 4 from a power source 5 connected in

circuit via lead 6 to a detection means 7 e.g. a voltage detector, and connected by lead 8 to the housing 2.

When the plunger 3, gob 1, housing 2 and other conventionally provided components of hollow glass article forming machinery are operating within intended temperature parameters, then upon retraction of the plunger 3 from the pre-formed gob 1 the plunger 3 retracts cleanly as indicted in Figure 1B and the circuit is broken instantaneously, or virtually so, as indicated by line 9 of Figure 2, the plunger 3 being inserted at time TI and retracted at time TR. If however, the temperatures of components such as the plunger 3 should stray outside intended parameters, e.g., by failure of cooling equipment, then the plunger 3 will not withdraw cleanly from the gob 1 but will tend to adhere to the gob 1 and slender spikes S or slivers of glass will be pulled by the retracting plunger from the pre-formed gob 1 as indicated in Figure 1C. This condition will be sensed in accordance with the method and apparatus of the invention by the detection means 7 detecting a waveform which is not the anticipated fall indicated by line 9 of Figure 2 of a "no spike" condition, but a gradual fall indicated by line 10 of Figure 2 as current continues to be conducted by the spike(s) S extending between the pre-formed gob 1 and the plunger. Upon detecting this alarm condition, remedial action can be taken immediately so that the machinery does not continue to produce faulty bottles etc. until the fault is, conventionally, detected by visual inspection.

CLAIMS

1. A method of detecting the formation of spikes during the manufacture of hollow glass articles comprising emitting a signal between the mould and the plunger/mechanism of the article forming means, receiving the emitted signal, and detecting any deviation in the received signal due to the presence of a spike(s), from a norm that is expected when no spike(s) exists.
2. A method as claimed in Claim 1, wherein the emitted signal is electrical, ultrasonic, R.F. microwave, light or vibration.
3. Apparatus for carrying out the method of Claim 1 or Claim 2, comprising;
 - (i) signal emitter means attachable to the plunger/mechanism or to the mould of forming means of a hollow glass article forming machine;
 - (ii) signal receiver means attachable to the mould or to the plunger/mechanism, respectively, to receive the emitted signal; and
 - (iii) detection means capable of determining whether the received signal has deviated, due to the presence of a spike(s), from a norm that is expected when no spike(s) exists.
4. Apparatus as claimed in Claim 3, wherein the emitter means emits an electrical signal, to be conducted from the plunger to the mould, with the plunger electrically insulated and a current is applied to the plunger whilst it is forced by its support and/or displacement mechanism into the

gob, the current flowing through the glass and into the mould, with the circuit completed via the mould.

5. Apparatus as claimed in Claim 4, provided with resistance and/or current and/or voltage sensing units, together with timing circuits, the sensing or measurement of a voltage etc. in a time slot exceeding the norm that is required to operate the machine satisfactorily, indicating that a spike is being formed.

6. Apparatus as claimed in Claim 4, wherein suitable circuitry is provided to enable analysis to be made of the electrical waveform produced during plunger retraction, with variation of the waveform from the expected norm indicating spike formation.

7. A method of detecting the formation of spikes during the manufacture of hollow glass articles substantially as hereinbefore described with reference to the accompanying drawings.

8. Apparatus for carrying out the method of Claims 1 and 7, substantially as hereinbefore described with reference to the accompanying drawings.